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Filed: November 13, 2001

For: System and Method Using Thermal Image Analysis for Polygraph Testing

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**Amendments to the Claims**

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

1. (currently amended) A method for use in detecting deception of a person, the method comprising:  
providing a plurality of frames of thermal image data of at least a region of a face of a person; and  
transforming the thermal image data to blood flow rate data for use in determining whether the person is deceptive or non-deceptive, wherein transforming the thermal image data comprises calculating change of blood flow rate over the plurality of frames based on of the thermal image data.
2. (currently amended) The method of claim 1, wherein determining whether the person is deceptive or non-deceptive comprises classifying the person as deceptive or non-deceptive based on a change of blood flow rate ~~over time~~ in the at least one region of the face.
3. (previously presented) The method of claim 1, wherein transforming the thermal image data comprises transforming the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.
4. (original) The method of claim 1, wherein providing the thermal image data comprises providing thermal image data of at least a region proximate an eye of the person.

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5. (original) The method of claim 1, wherein providing the thermal image data comprises providing thermal image data of more than one region of the face of the person.
6. (original) The method of claim 1, wherein providing thermal image data comprises:  
asking the person a question to elicit a response therefrom;  
focusing a thermal infrared image device operable to provide thermal image data on at least the region of the face of the person; and  
capturing thermal image data during at least a period of time during at least the response from the person.
7. (original) The method of claim 6, wherein determining whether the person is deceptive or non-deceptive based on the blood flow rate data comprises determining whether the person is being deceptive or non-deceptive with respect to the response to the question.
8. (previously presented) The method of claim 1, wherein providing thermal image data comprises:  
focusing a thermal infrared image device operable to provide thermal image data on at least the region of the face of the person;  
capturing the plurality of frames of thermal image data during at least a period of time;  
and  
tracking movement of at least the region of the face of the person.
8. (previously presented) The method of claim 1, wherein the method further comprises providing measurement of at least one physiological parameter different than change of blood flow rate obtained using thermal image data, and further wherein determining whether the person is deceptive or non-deceptive comprises determining whether the person is deceptive or non-deceptive based on change of blood flow rate obtained using thermal image data and the at least one physiological parameter.

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9. (previously presented) The method of claim 9, wherein determining whether the person is deceptive or non-deceptive comprises:

making a preliminary determination of whether the person is deceptive or non-deceptive based on the at least one physiological parameters and making preliminary determination based on change of blood flow rate obtained using thermal image data; and

confirming one preliminary determination by comparing it to the other.

11. (previously presented) The method of claim 9, wherein providing measurement of at least one physiological parameters comprises providing measurement of the at least one physiological parameters using at least one invasive technique.

12. (currently amended) A system for use in detecting deception of a person, the system comprising:

a thermal infrared image device operable to provide a plurality of frames of thermal image data of at least a region of a face of a person; and

a computing apparatus operable upon the thermal image data to transform the thermal image data to blood flow rate data for use in determining whether the person is deceptive or non-deceptive, wherein the transformation of the thermal image data to blood flow rate data comprises calculating change of blood flow rate over the plurality of frames ~~based on~~ of the thermal image data.

13. (currently amended) The system of claim 12, wherein the computing apparatus is further operable to classify the person as deceptive or non-deceptive based on a change of blood flow rate ~~over time~~ in the at least one region of the face.

12. (previously presented) The system of claim 12, wherein the computing apparatus is

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further operable to transform the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

13. (original) The system of claim 12, wherein the thermal infrared image device is operable to provide thermal image data of at least a region proximate an eye of the person.

14. (original) The system of claim 12, wherein the thermal infrared image device is operable to provide thermal image data of more than one region of the face of the person.

15. (original) The system of claim 12, wherein the thermal infrared image device is operable to capture thermal image data during at least a period of time during at least an elicited response from the person.

16. (original) The system of claim 17, wherein the computing apparatus is operable to determine whether the person is deceptive or non-deceptive based on the blood flow rate data corresponding to the thermal image data captured during at least the elicited response.

17. (previously presented) The system of claim 12, wherein the thermal infrared image device is operable to capture the plurality of frames of thermal image data during at least a period of time, and further wherein the computing apparatus is further operable to track movement of at least the region of the face of the person during the period of time.

20. (previously presented) The system of claim 12, wherein the system further comprises means for providing measurement of at least one physiological parameters different than change of blood flow rate obtained using thermal image data, and further wherein the computing apparatus is operable to determine whether the person is deceptive or non-deceptive based on the

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blood flow rate data obtained using thermal image data and the at least one physiological parameter.

21. (previously presented) The system of claim 20, wherein the computing apparatus is further operable to make a preliminary determination of whether the person is deceptive or non-deceptive based on the at least one physiological parameters and to make a preliminary determination of whether the person is deceptive or non-deceptive based on the blood flow rate data obtained using thermal image data, and thereafter, the computing apparatus is operable to confirm one preliminary determination by comparison to the other.

22. (previously presented) The system of claim 20, wherein the means for providing measurement of at least one physiological parameters different than change of blood flow rate obtained using thermal image data comprises invasive means for providing invasive measurement of at least one physiological parameter different than change of blood flow rate.

23. (currently amended) A polygraph method for use in determining whether a person is being deceptive or non-deceptive with respect to a response elicited from the person, the method comprising:

capturing a plurality of frames of thermal image data from at least one region of the face of the person during at least the elicited response;

transforming the thermal image data to blood flow rate data, wherein transforming the thermal image data to blood flow rate data comprises calculating change of blood flow rate over the plurality of the frames ~~based on~~ of the thermal image data; and

classifying the person as deceptive or non-deceptive with respect to the elicited response based on the blood flow rate data.

24. (previously presented) The method of claim 23, wherein transforming the thermal image data comprises transforming the thermal image data using a thermodynamic model where

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change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

25. (original) The method of claim 23, wherein capturing the thermal image data comprises capturing thermal image data of at least a region proximate an eye of the person.

26. (original) The method of claim 23, wherein capturing the thermal image data comprises capturing thermal image data of more than one region of the face of the person.

27. (original) The method of claim 23, wherein the method further comprises tracking movement of at least the region of the face of the person during the capturing of the thermal image data.

28. (previously presented) The method of claim 23, wherein the method further comprises providing measurement of at least one physiological parameter different than the change in blood flow rate obtained using thermal image data, and wherein classifying the person as deceptive or non-deceptive comprises determining whether the person is deceptive or non-deceptive based on the change of blood flow rate and the at least one physiological parameter.

29. (previously presented) The method of claim 28, wherein providing measurement of the at least one physiological parameter comprises providing measurement of at least one physiological parameters different than blood flow rate data obtained using thermal image data using at least one invasive method.

30. (previously presented) A method for use in monitoring blood flow rate, the method comprising:

providing a plurality of frames of thermal image data of at least a region of a face of a person; and

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transforming the thermal image data to blood flow rate information, wherein transforming the thermal image data to blood flow rate information comprises calculating change of blood flow rate over the plurality of the frames.

31. (previously presented) The method of claim 30, wherein transforming the thermal image data comprises transforming the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

32. (original) The method of claim 30, wherein providing the thermal image data comprises providing thermal image data of at least a region proximate an eye of the person.

33. (original) The method of claim 30, wherein providing the thermal image data comprises providing thermal image data of more than one region of the face of the person.

34. (previously presented) The method of claim 30, wherein providing thermal image data comprises:

focusing a thermal infrared image device operable to provide thermal image data on at least the region of the face of the person;

capturing the plurality of frames of thermal image data during at least a period of time;

and

tracking movement of at least the region of the face of the person.

35. (original) The method of claim 30, wherein the method further comprises determining a physiological state of the person based on the blood flow rate information.

36. (currently amended) A system for use in monitoring blood flow rate, the system comprising:

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a thermal infrared image device operable to provide a plurality of frames of thermal image data of at least a region of a face of a person; and

a computing apparatus operable upon the thermal image data to transform the thermal image data to blood flow rate information, wherein the transformation of the thermal image data to blood flow rate data comprises calculating change of blood flow rate over the plurality of the frames based on of the thermal image.

37. (previously presented) The system of claim 36, wherein the computing apparatus is operable to transform the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

38. (original) The system of claim 36, wherein the computing apparatus is further operable to determine a physiological state of the person based on the blood flow rate information.

39. (original) The system of claim 36, wherein the thermal infrared image device is operable to provide thermal image data of at least a region proximate an eye of the person.

40. (previously presented) The system of claim 36, wherein the thermal infrared image device is operable to capture the plurality of frames of thermal image data during at least a period of time, and further wherein the computing apparatus is further operable to track movement of at least the region of the face of the person during the period of time.

41. (previously presented) A method for use in detecting deception of a person, the method comprising:

providing thermal image data of at least a region of a face of a person; and

transforming the thermal image data to blood flow rate data for use in determining whether the person is deceptive or non-deceptive, wherein transforming the thermal image data



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comprises transforming the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

42. (currently amended) The method of claim 41, wherein determining whether the person is deceptive or non-deceptive comprises classifying the person as deceptive or non-deceptive based on a change of blood flow rate over time in the at least one region of the face.

43. (previously presented) The method of claim 41, wherein providing the thermal image data comprises providing thermal image data of at least a region proximate an eye of the person.

44. (previously presented) The method of claim 41, wherein providing thermal image data comprises:

- asking the person a question to elicit a response therefrom;
- focusing a thermal infrared image device operable to provide thermal image data on at least the region of the face of the person; and
- capturing thermal image data during at least a period of time during at least the response from the person.

45. (previously presented) A system for use in detecting deception of a person, the system comprising:

- a thermal infrared image device operable to provide thermal image data of at least a region of a face of a person; and
- a computing apparatus operable upon the thermal image data to transform the thermal image data to blood flow rate data for use in determining whether the person is deceptive or non-deceptive, wherein transforming the thermal image data comprises using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

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46. (currently amended) The system of claim 45, wherein the computing apparatus is further operable to classify the person as deceptive or non-deceptive based on a change of blood flow rate over time in the at least one region of the face.

47. (previously presented) The system of claim 45, wherein the thermal infrared image device is operable to provide thermal image data of at least a region proximate an eye of the person.

48. (previously presented) The system of claim 45, wherein the thermal infrared image device is operable to capture thermal image data during at least a period of time during at least an elicited response from the person, and further wherein the computing apparatus is operable to determine whether the person is deceptive or non-deceptive based on the blood flow rate data corresponding to the thermal image data captured during at least the elicited response.

49. (previously presented) A polygraph method for use in determining whether a person is being deceptive or non-deceptive with respect to a response elicited from the person, the method comprising:

capturing thermal image data from at least one region of the face of the person during at least the elicited response;

transforming the thermal image data to blood flow rate data representative of a change of blood flow rate over time in the at least one region of the face, wherein transforming the thermal image data comprises transforming the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body; and

classifying the person as deceptive or non-deceptive with respect to the elicited response based on the blood flow rate data.

50. (previously presented) The method of claim 49, wherein capturing the thermal image

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data comprises capturing thermal image data of at least a region proximate an eye of the person.

51. (previously presented) A method for use in monitoring blood flow rate, the method comprising:

providing thermal image data of at least a region of a face of a person; and  
transforming the thermal image data to blood flow rate information, wherein  
transforming the thermal image data comprises transforming the thermal image data using a  
thermodynamic model where change of blood flow rate is inversely proportional to the square of  
skin temperature deviation from a core temperature of a human body.

52. (previously presented) The method of claim 51, wherein providing the thermal image  
data comprises providing thermal image data of at least a region proximate an eye of the person.

53. (previously presented) The method of claim 51, wherein providing the thermal image  
data comprises providing thermal image data of more than one region of the face of the person.

54. (previously presented) The method of claim 51, wherein providing thermal image data  
comprises:

focusing a thermal infrared image device operable to provide thermal image data on at  
least the region of the face of the person;  
capturing frames of thermal image data during at least a period of time; and  
tracking movement of at least the region of the face of the person.

55. (previously presented) The method of claim 51, wherein the method further comprises  
determining a physiological state of the person based on the blood flow rate information.

56. (previously presented) A system for use in monitoring blood flow rate, the system  
comprising:

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a thermal infrared image device operable to provide thermal image data of at least a region of a face of a person; and

a computing apparatus operable upon the thermal image data to transform the thermal image data to blood flow rate information, wherein the computing apparatus is operable to transform the thermal image data using a thermodynamic model where change of blood flow rate is inversely proportional to the square of skin temperature deviation from a core temperature of a human body.

57. (previously presented) The system of claim 56, wherein the computing apparatus is further operable to determine a physiological state of the person based on the blood flow rate information.

58. (previously presented) The system of claim 56, wherein the thermal infrared image device is operable to provide thermal image data of at least a region proximate an eye of the person.

59. (previously presented) The system of claim 56, wherein the thermal infrared image device is operable to capture frames of thermal image data during at least a period of time, and further wherein the computing apparatus is further operable to track movement of at least the region of the face of the person during the period of time.